

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ³ : G06F 15/30; G06K 5/00	A1	(11) International Publication Number: WO 82/00213 (43) International Publication Date: 21 January 1982 (21.01.82)
--	----	---

(21) International Application Number: PCT/US81/00431
(22) International Filing Date: 2 April 1981 (02.04.81)

(31) Priority Application Number: 166,689

(32) Priority Date: 2 July 1980 (02.07.80)

(33) Priority Country: US

(71) Applicant; and

(72) Inventor: BENTON, William, M. [US/US]; Route 1, Box 191, Middleburg, VA 22117 (US).

(74) Agents: BECKER, Stephen, A. et al.; Lowe, King, Price & Becker, 2001 Jefferson Davis Highway, Arlington, VA 22202 (US).

(81) Designated States: DE (European patent), FR (European patent), GB (European patent), JP, SE (European patent).

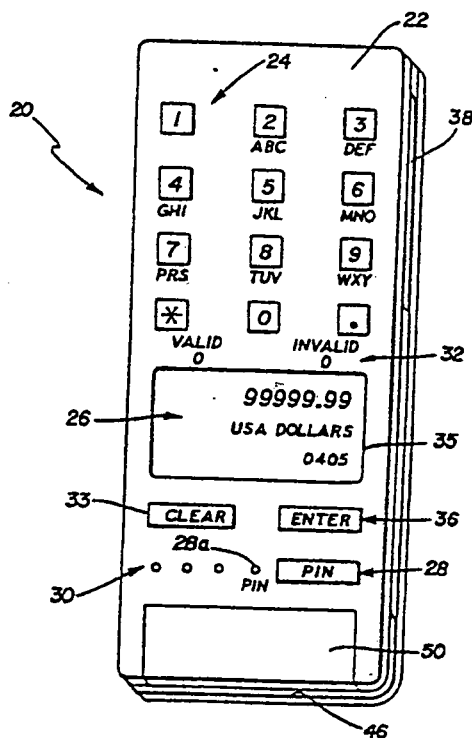
Published

With international search report

(54) Title: ELECTRONIC FUNDS TRANSFER AND VOUCHER ISSUE SYSTEM

(57) Abstract

In a system for transferring electronic funds data in lieu of cash between vendees and vendors associated with a sponsoring financial institution, each vendee is provided with an identification card (40) and a portable electronic device (20) to be presented to the vendor upon making a purchase. The electronic device contains a keyboard (24) for entering a vendee identification number as well as the purchase amount and a memory for storing a corresponding identification number, account balance and transaction amount. The portable electronic device contains a first inlet (38) for receiving an edge of the identification card. A magnetic head (44) reads data recorded on the card to turn the device on if the card corresponds to the particular device. A second inlet (46) within the device receives vouchers (48) prepared by the vendor reflecting the amount of the transaction. Manually operated printing rolls (54, 56) within the second inlet print a series of encoded bands on the voucher to verify the transaction if the vendee is satisfied with the purchase. If the vendee has keyboard entered the correct identification number and the account balance is large enough to support the purchase, the account balance stored in memory is debited by the purchase amount during a voucher printing cycle. The identification card and associated electronic device can be used in environments other than funds data transfer, e.g., access security.



JUMBO PATENT
DUE TO ITS EXCESSIVE LENGTH,
COMPLETE PATENT FURNISHED
UPON SPECIAL REQUEST ONLY.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	KP	Democratic People's Republic of Korea
AU	Australia	LI	Liechtenstein
BR	Brazil	LU	Luxembourg
CF	Central African Republic	MC	Monaco
CG	Congo	MG	Madagascar
CH	Switzerland	MW	Malawi
CM	Cameroon	NL	Netherlands
DE	Germany, Federal Republic of	NO	Norway
DK	Denmark	RO	Romania
FI	Finland	SE	Sweden
FR	France	SN	Senegal
GA	Gabon	SU	Soviet Union
GB	United Kingdom	TD	Chad
HU	Hungary	TG	Togo
JP	Japan	US	United States of America

- 1 -

ELECTRONIC FUNDS TRANSFER AND VOUCHER ISSUE SYSTEMTECHNICAL FIELD:

5 The present invention relates generally
to access security systems, and more particularly,
to an off-line electronic funds transfer system
including a portable electronic device that stores
account and identification data to authorize
transactions and following transactions prints
10 verification data onto vouchers.

BACKGROUND ART:

Several prior art systems of which I am
aware have been provided for enabling electronic
15 funds transfer to be made between vendees and
vendors in lieu of cash. In Moreno 4,007,355,
for example, cashless transactions are made using
vendee and vendor credit cards through a special
interface apparatus located at the vendor station.
20 The cards themselves contain funds data storage
capability. No voucher verifying the transaction
is issued. Haker 4,032,931 discloses a keyboard
assembly for transferring financial data between
vendees and vendors. No cards are involved and
25 funds data transfer is made during each transaction
between the point of sale and a central computer.

Riccitelli 3,934,122, Schatz 4,001,550
and Dethloff 4,105,156 are examples of electronic
funds transfer systems wherein credit cards containing
30 memory devices store account balance and
other information to be accessed during funds
transfer transactions. There is no provision
in these systems, however, for determining whether
the transaction is authorized based upon vendee
35 identification and account balance and no provision



- 2 -

for issuing a voucher verifying the transaction.

Foudos 4,053,735 discloses a portable electronic device for issuing bank-assured checks wherein a credit amount is loaded into memory and transaction amounts successively debited from the credit balance. If the vendee keyboard enters correct vendee identification data, and the purchase amount, also keyboard entered, is less than the present account balance, the vendee is authorized to manually operate a check printer incorporated within the device for issuing the assured check.

In Link 3,651,310, a combination voucher and printer and credit card validator reads an identification number recorded on a credit card while imprinting the voucher and transmits this number to a memory. The credit card number is compared with a list of invalid credit card numbers to determine card validity.

In Nagata 4,197,986, a funds data transfer system is disclosed which is usable both on-line and off-line to authorize transactions. Account balance is stored on a credit card and electrically up-dated following each transaction. The card also controls issuance of a sales slip.

Goldman 3,982,103 discloses a credit card transaction verifier that reads account balance data as well as additional data magnetically recorded on a credit card. The recorded data are up-dated following each transaction. The verifier is adapted to operate either on-line or off-line.

In Case et al. 4,172,552, a credit card processing system includes a reader for reading data encoded in the magnetic stripe of a card.



- 3 -

The same data are printed at the point of sale along the bottom of the vendor's bank sales slip. The card reader makes cuts in the bank copy to designate the transaction as a credit or charge transaction.

Two portable, microprocessor based calculator units for continuously storing account balance and transaction information are marketed by JS&A, 1 JS&A Plaza, Northbrook, Illinois 60062. The first device, known as "CORVUS CHECK-MASTER"; keeps a running balance of expenditures against a total balance, alterable at any time by the user. The second device, known as "ELECTRONIC WALLET", contains two non-volatile memories for storing two difference balances that are selectively debited by entering transaction data at a keyboard. Neither device, however, is capable of verifying transactions or issuing validated transaction vouchers.

Accordingly, one object of the present invention is to provide a system for performing electronic funds transfer in lieu of cash transactions and for issuing transaction verifying vouchers in duplicate, wherein the copy is retained by the vendee for record keeping.

Another object is to provide such an electronic funds transfer system wherein the vouchers are printed with encoded data at the point of sale to verify completion of the transaction.

Another object is to provide such an electronic funds transfer system wherein each vendee is provided with a portable electronic device that verifies that the vendee is authorized to make a purchase transaction based upon proper entry of a vendee identification number as well as



- 4 -

by verification of an adequate account balance.

5 A further object is to provide a new and improved electronic funds transfer device which stores account and transaction data and verifies vouchers or drafts by imprinting encoded data on the voucher or draft upon completion of each authorized transaction.

10 Another object is to provide a new and improved electronic funds transfer device that is portable and microprocessor based, is small enough to be carried in a wallet and has a width equal to the width of a standard credit card.

15 In commercial transactions, checks are mailed by the vendor to the issuing banks where the checks are posted, cancelled and returned by mail to the vendees. This process, known as check truncation, is expensive and costs of truncation increase with increasing postage rates. On ACH (Automatic Clearinghouse) banks are now
20 permitted by the Government to issue a statement to customers summarizing previous transactions rather than returning cancelled checks. Customers, however, tend to prefer receiving cancelled checks for permanent record keeping.

25 An additional object of the invention, therefore, is to provide a system for transferring electronic funds data between vendees and vendors in lieu of cash, wherein a verified voucher is issued confirming each completed transaction,
30 the voucher is forwarded by the vendor to the sponsoring institution and a copy of the voucher is retained by the vendee, thereby eliminating conventional check truncation.



- 5 -

DISCLOSURE OF INVENTION:

In a system for providing electronic funds transfer in lieu of cash between vendees and vendors under the sponsorship by an authorized financial institution, each vendee carries an identification card and pocket-sized, microprocessor based electronic device, or verificatory, that stores account and transaction data and imprints encoded data on vouchers or drafts presented by vendors for verification during transactions. Each verificatory includes a keyboard for entering identification and transaction data and a readout for displaying the account balance and amount of a current transaction. In addition, the verificatory includes sequence indicator lamps for requesting input data and displaying valid and invalid entries.

A first inlet at one side of the verificatory is adapted to receive an edge of the identification card having institution issued indicia recorded thereon. An electromagnetic head within the first inlet reads the card data for comparison with prerecorded corresponding data. If there is a match between the card data and prerecorded data, the keyboard is enabled.

A second inlet at one end of the verificatory is adapted to receive vouchers or drafts supplied by the vendor for verification following authorization and completion of a requested purchase transaction. A set of printing rolls within the second inlet prints encoded verification bands on the draft or voucher to verify completion of the transaction. The set of rolls comprises a pair of rolls normally separated from each other at the inlet to permit the voucher or draft to be inserted between them. The upper roll contains a series of bands having



- 6 -

widths and interband spacings corresponding to data identifying the vendee account. To complete a purchase transaction, the vendee manually moves the identification band roller into contact with the voucher to impart there-
5 to the identification band verification markings.

In operation, the vendee presents his card and verificatory at the point of sale, and enables the device by inserting the identification
10 card into the first inlet in the verificatory. The vendee then removes the identification card from the verificatory and hands the card to the vendor for preparation of a voucher using a conventional credit card imprinter of a type supplied,
15 for example, by Addressograph-Multigraph, International. To make a payment, the vendee keyboard enters the amount of the transaction and presses an ENTER key. The transaction amount is displayed
20 in the readout. The vendee is then instructed by the verificatory via the sequence indicator to keyboard enter the personal identification number. The verificatory now automatically compares the keyboard entered identification number with
25 a prerecorded identification number in ROM and compares the keyboard entered transaction amount with the account balance stored in RAM. As a safeguard, the device is programmed to respond to entry of an incorrect personal identification
30 number. If the keyboard entered personal identification number does not match the stored personal identification number, the vendee is required to make two successive entries of the correct personal identification number. This procedure
35 reduces the possibility of use of the device



- 7 -

by an unauthorized vendee attempting to enter identification data based on guess work.

Assuming that the keyboard entered identification number matches the stored identification number and that the keyboard entered transaction amount is less than or equal to the stored account balance, the sequence indicator will indicate to the vendee and vendor that the transaction is authorized. The voucher, prepared by the vendor to indicate the transaction amount, is inserted into the second inlet of the verificatory between the printing rolls. The banded printing roll is now pressed against the voucher and the voucher withdrawn from the inlet to make the verification markings. As the verification markings are being printed onto the voucher, the amount of the requested transaction is subtracted from the account balance stored in RAM and the result is stored. The account balance and amount of last transaction are displayed on demand using, respectively, the "0" and "*" keys.

The identification card and associated verificatory can be used in systems other than funds data transfer, e.g., access security. Access to a restricted area is given only to authorized personnel by inserting a security card held by the candidate requesting entry into the verificatory and having the candidate keyboard enter his personal identification number. If entry is authorized the verificatory signals the authorization and prints an approval voucher. The voucher is later machine read to provide a traffic summary.

Still other objects and advantages of the present invention will become readily apparent



- 8 -

to those skilled in this art from the following detailed description, wherein I have shown and described only the preferred embodiment of the invention, simply by way of illustration of the best mode contemplated by me of carrying out my invention. As will be realized, the invention is capable of other and different embodiments, and its several details are capable of modifications in various obvious respects, all without departing from the invention. Accordingly, the drawings and description are to be regarded as illustrative in nature, and not as restrictive.

BRIEF DESCRIPTION OF DRAWINGS:

Figure 1 is a perspective view of a microprocessor based, electronic funds transfer device in accordance with the invention;

Figure 2 is a back view of the device in Figure 1 showing a memory access terminal and back plate lock;

Figure 3 is a side view of the device in Figure 1 showing the first inlet for receiving an encoded portion of an identification card;

Figure 4 is an end view of the device in Figure 1 showing the second inlet for receiving vouchers for verification;

Figure 5 is a top view of an identification card used in the invention;

Figure 6 is a top view of a voucher used in the invention;

Figure 7 is a cross sectional view of the device in Figure 1 exposing the card reader within the first inlet;

Figure 8 is a cross sectional view of the device in Figure 1 showing details of the printing rolls;



- 9 -

Figure 9 is a perspective view of the banded printing roll shown in Figure 8;

Figure 10 is a block diagram of circuitry constituting the device in Figure 1; and

5 Figures 11a-11d are a block diagram representing firmware for programming the microprocessor shown in Figure 1.

BEST MODE FOR CARRYING OUT THE INVENTION:

10 Referring to Figures 1-4, an electronic device 20, referred to hereinafter as verificatory, is used together with an identification card 40 (Figure 5) to determine whether an individual presenting the card is authorized to receive a privilege
15 issued by a sponsoring institution, e.g., to gain access to a security area or to complete a funds data transaction, and upon authorization, to issue an encoded verification document. Although the present invention is applicable in many limited
20 access environments, the present description shall be directed by way of example to electronic funds data transfer.

Verificatory 20 includes an impact resistant plastic housing 22 carrying a push button keyboard
25 24, a first display 26 for displaying account and transaction data and a second display 30 for displaying the operating sequence of the verificatory. Housing 24 also carries a third display 32 indicating whether a requested transaction
30 is valid or invalid, a key 33 for clearing keyboard entered data, a key 28 for enabling the verificatory to accept a vendee personal identification number (PIN) and an ENTER key 36 for causing the verifi-
35 catory to accept keyboard entered data. A first inlet 38 at one side of the housing 22 receives



- 10 -

an edge portion of the identification card 40 for reading data magnetically encoded on stripe 42 (see Figure 5). The magnetic data are read by an electromagnetic head 44 located within the housing 22 adjacent inlet 38, as shown in Figure 7.

A second inlet 46 positioned at one end of the housing 22 is adapted to receive vendor issued transaction vouchers, such as voucher 48 shown in Figure 6. Adjacent the inlet 46 of the housing 22 is a manually depressable bar 50 that causes encoded verification data in the form of bands 51 (see Figure 6) to be printed on an end portion of the voucher 48. A gate 57 suspended from print bar 50 at pivot 59 and spring biased in a closed position encloses the inlet 46 in the absence of a voucher 48. The gate 57 provides two functions; it seals the inlet from ingress of dust and makes it impossible to initiate a print cycle by depressing bar 50 in the absence of a voucher 48.

Referring to Figure 8, a pair of printing rolls 54 and 56 are rotatably supported on bar 50 and lower housing portion 53 within recesses 58 and 60, respectively. The bar 50 in turn is supported on upper housing portion 55 (Figure 3) by pins 62 that ride within elongated slots 64 formed in the housing. The bar 50 is biased by springs (not shown) into the position shown in Figure 8 wherein roll 54 is separated from roll 56 by a distance substantially larger than the thickness of a voucher 48. The upper roll 54, shown in detail in Figure 9, is formed with surface bands 66 having widths and interband spacings corresponding to data identifying the vendee. The band portions 66 of the upper roll 54 are



- 23 -

and the program is stopped (block 226).

Assuming that a pay request has been made in accordance with block 126, the account balance stored at RAM location 0100 is loaded into accumulator A (step 228). The contents of accumulators A and B (accumulator B contains the amount of the purchase transaction obtained from RAM location 0101 in accordance with block 200) are compared (block 230). If the content of accumulator A is less than the content of accumulator B (block 232) indicating that there are insufficient funds to support the payment transaction, subroutine 0205 (block 234) is executed to energize the INVALID lamp and the program is stopped (block 236). If the content of accumulator A is greater than or equal to the content of accumulator B, on the other hand, indicating that there are sufficient funds to support the requested payment transaction, subroutine 0206 stored in RAM is executed to energize the VALID lamp (block 238).

The content of accumulator B identifying the transaction amount is displayed at readout 26 (block 240) and the program is interrupted (block 242). The program interruption is removed in response to closure of switch 69 (Figure 10) during a transaction verification printing operation using print bar 50 (block 244). The amount of the transaction stored in accumulator A is subtracted from the account balance stored in accumulator B (block 246) and the resultant balance is stored at RAM location 0100 (block 248). The content of accumulator B (transaction amount) is stored at RAM location 0102 (block 250). The display subroutine at ROM location 0207 is now executed to display the word PAID on the alphanumeric



- 24 -

display of readout 26 (block 252). Accumulators A and B as well as RAM location 101, 103, 106 and 107 are cleared (block 252) and the program is stopped (block 254).

5 In this disclosure there is shown and described only the preferred embodiment of the invention, but, as aforementioned, it is to be understood that the invention is capable of use in various other combinations and environments
10 and is capable of changes or modifications within the scope of the inventive concept as expressed herein. For example, the verificatory 20 in addition to financial security is useful and beneficial in personnel security to authorize
15 entry to a restricted area or to provide personnel identification. The verificatory 20 sans printer may, for example, be carried by a person seeking entry to a restricted area and an imprinter maintained by a guard. A prearranged pass code number is
20 displayed to the guard. The pass code display is displayed in the device for next guard who may require still another number. The imprinted document becomes a record of entry. A copy becomes part of the badge to be carried by the authorized
25 entrant. The verificatory 20 will gradually run out of authorization numbers which will require reloading. This is another security feature as high security would require limited number of authorized entrants. In another mode, the
30 verificatory and imprinter are both maintained by the guard and the authorized person has the card and knows the PIN number. A different coded magnetic card would operate the verificatory in highly restricted areas and would require
35 knowledge of a different PIN number. In still



- 25 -

another mode, armies, especially armies on foreign soil, could receive pay or portion via loading of the device and still use the device in its simple form for security entry and identification.

5 The service serial number of the individual would be programmed in the verifactory as the personal identification number. Of particular significance, a single verifactory 20 may be used in the financial and access security environments as well as other

10 environments without modification.

The system described above, while ideal in an electronic funds transfer (EFT) environment will also guarantee standard checks by imprinting verification bands on the back of the check while

15 debiting the account balance stored in the verifactory 20.



- 26 -

CLAIMS:

1. An apparatus for transferring funds data in lieu of cash, comprising a portable unit
5 to be carried by a vendee, said portable unit including a keyboard for manually entering transaction and identification data, terminal means accessible only by an authorized institution for receiving an initial funds balance; means coupled to said
10 terminal means for storing a funds balance, means responsive to said keyboard for storing a requested transaction amount, means for storing vendee identification data issued by said institution, means responsive to said keyboard for storing
15 vendee entered identification data, means for comparing said stored identification data with said keyboard entered identification data and for generating a first signal in response to a positive comparison, means for comparing said
20 stored funds balance with said requested transaction amount and for generating a second signal if said funds balance is at least as large as said requested transaction amount, an inlet for receiving a voucher issued by a vendor, manually actuated
25 printing roll means within said inlet for printing encoded identification data onto said voucher to verify the transaction, means for maintaining said printing roll means normally out of contact with said voucher within said inlet, means for
30 manually moving said printing roll means into contact with said voucher, means responsive to said manual means and to said first and second signals for updating said stored funds balance by said requested transaction amount, and display
35 means for displaying said stored funds balance



- 27 -

and said requested transaction amount.

2. A system for transferring funds data
between a vendee and vendor in lieu of cash,
5 comprising a fixed unit located at a sponsoring
institution for generating credit data to be
provided to member vendees; an identification
card carried by each of said vendees containing
prerecorded vendee identification data; pluralities
10 of vouchers carried by member vendors for recording
purchase amounts; and a portable unit to be carried
by each of said vendees for making purchases,
said portable unit including a keyboard for manually
entering transaction and identification data,
15 terminal means accessible by only the sponsoring
institution for receiving an initial funds balance
corresponding to initial credit; means coupled
to said terminal means for storing a funds balance;
means responsive to said keyboard for storing
20 a requested transaction amount; means for storing
vendee identification data issued by said institution;
means responsive to said keyboard for storing
vendee entered identification data; means for
comparing said stored identification data with
25 said keyboard entered identification data and
for generating a first signal in response to
a positive comparison; means for comparing said
stored funds balance with said requested transaction
amount and for generating a second signal if
30 said funds balance is at least as large as said
requested transaction amount; an inlet for receiving
singly said vouchers issued by the vendor; manually
actuated printing roll means within said inlet
for printing encoded identification data onto
35 said voucher to verify the transaction; said



- 28 -

printing roll means including means for maintaining
said printing roll means normally out of contact
with said voucher, means for manually moving
said printing roll means into contact with said
5 voucher, means responsive to said manual means
and to said first and second signals for updating
said stored funds balance by said requested transaction
amount, and display means for displaying said
stored funds balance and said requested transaction
10 amount.

3. The apparatus of claim 1 or claim
2, wherein said printing roll means includes
a roll containing longitudinally spaced apart
15 bands having widths and interband spacings corresponding
to said encoded identification data.

4. The apparatus of claim 1, wherein
the portable unit includes a second inlet for
20 receiving at least an edge portion of an encoded
card, means within said second inlet for reading
data on said card, means for comparing said card
read data with prerecorded data and means responsive
to said comparing means for enabling said keyboard.
25

5. The apparatus of claim 2, wherein
said portable unit includes a second inlet for
receiving at least an edge portion of said identifi-
cation card, means within said second inlet for
30 reading data on said card, means for comparing
said card data with prerecorded data and means
responsive to said comparing means for enabling
said keyboard.

35 6. The invention of claim 4 or claim



- 29 -

5, including means responsive to said card reading means for displaying data corresponding to card read data to be recorded by said vendor.

5 7. The invention of claim 1 or claim 2, wherein said display means includes a numerical readout for displaying stored numerical data.

10 8. The apparatus of claim 7, wherein said display means further includes status lamps for indicating an operating status of said micro-processor.

15 9. An apparatus for transferring funds data in lieu of cash, comprising a portable unit to be carried by a vendee, said portable unit including a keyboard for manually entering transaction identification data, terminal means accessible only by an authorized institution for receiving
20 an initial funds balance, means coupled to said terminal means for storing a funds balance, means responsive to said keyboard for storing a requested transaction amount, means for storing vendee identification data issued by said institution,
25 means responsive to said keyboard for storing vendee entered identification data, means for comparing said stored identification data with said keyboard entered identification data and for generating a first signal in response to
30 a positive comparison, means for comparing said stored funds balance with said requested transaction amount and for generating a second signal if said funds balance is at least as large as said requested transaction amount, a first inlet for
35 receiving at least an edge portion of an identification



- 30 -

card, means within said first inlet for reading
data prerecorded on said card, means for comparing
said card read data with stored data, means responsive
to said card data comparing means for enabling
5 said keyboard, a second inlet for receiving a
voucher issued by a vendor, manually actuated
printing means within said second inlet for printing
encoded identification data onto said voucher
to verify the transaction, and means responsive to
10 said printing means and to said first and second
signals for up-dating said stored funds balance
by said requested transaction amount.

10. The apparatus of claim 9, including
15 display means for displaying said stored funds
balance and said requested transaction amount.

11. The apparatus of claim 9, including
means for displaying a number related to the
20 card read data, the vendor recording said displayed
number on said voucher to complete verification
of said transaction.

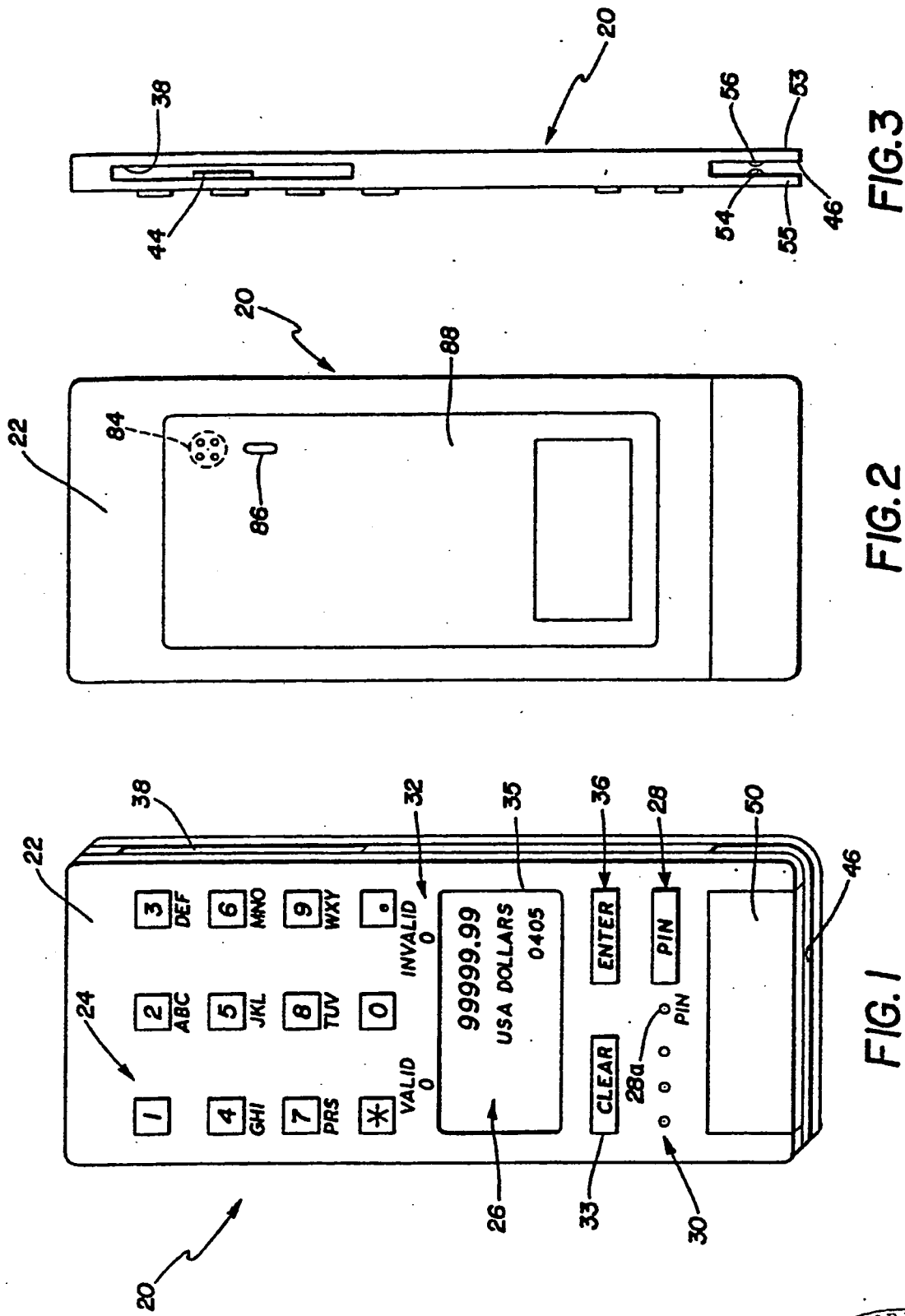
12. A system for identifying an individual
25 as being authorized to overcome a general restriction,
comprising an identification card carried by
each authorized individual containing prerecorded
identification data, pluralities of vouchers
located at verification stations and a portable
30 unit to be carried by each authorized individual, each
said portable unit including a keyboard for manually
entering identification data, means for storing prerecorded
identification data, means for storing changable data,
means responsive to said keyboard and to said stored identi-
35 fication data for making a comparison between the keyboard



entered identification data and stored identification data, a first inlet for receiving at least an edge portion of said identification card, means within said first inlet for reading encoded data
5 on said card, means for comparing said card read data with corresponding prerecorded card data, means responsive to said card data comparing means for enabling said keyboard, a second inlet for receiving vouchers, printing means within
10 said second inlet for printing verification data on said vouchers and means responsive to said printing means and said first comparing means for up-dating said stored changable data.

15 13. The invention as defined in any of claims 1, 2, 9 or 12 including a flap for enclosing said print roll inlet, said flap being biased into a position to disable said printing roll means in the absence of a voucher.





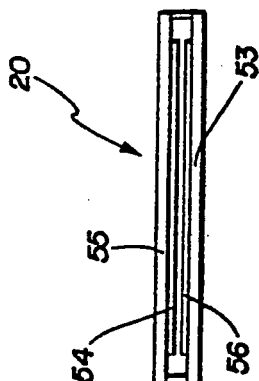


FIG. 4

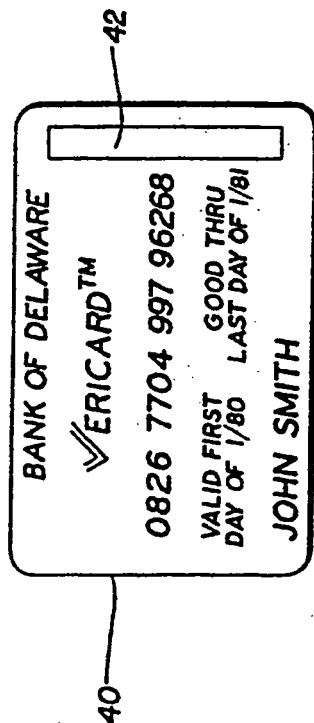


FIG. 5

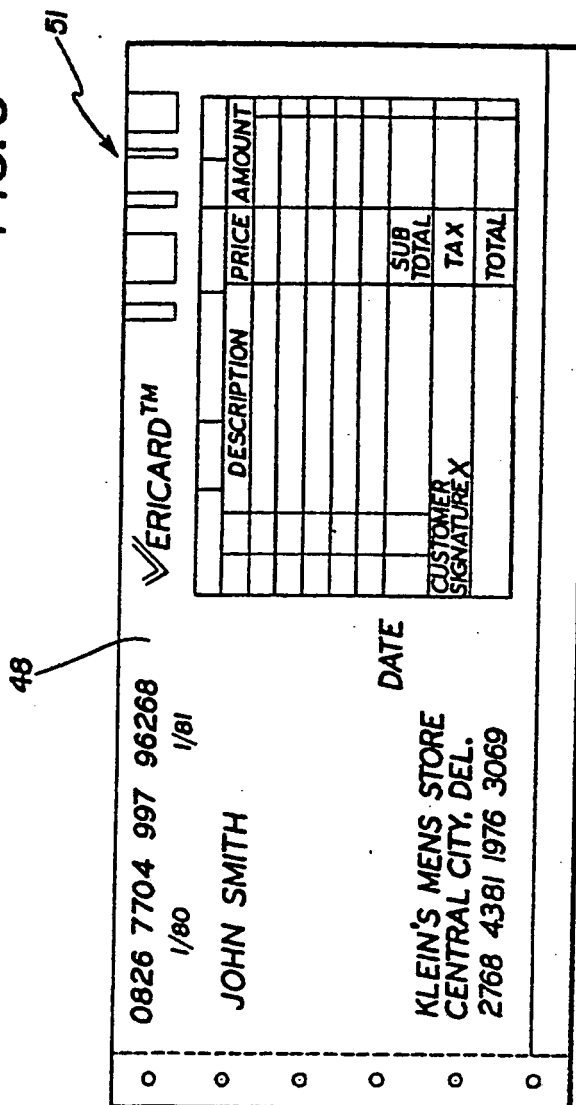


FIG. 6



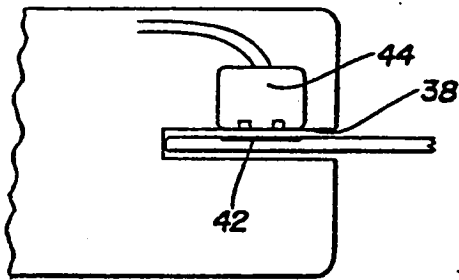


FIG. 7

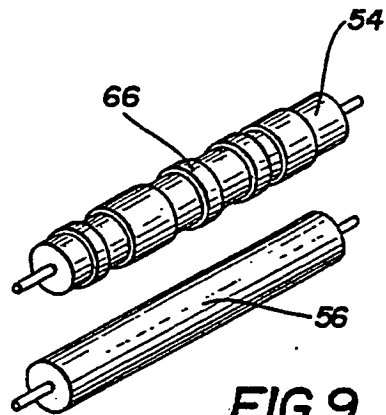


FIG. 9

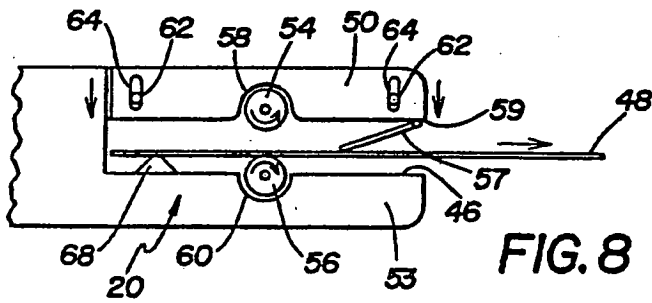


FIG. 8

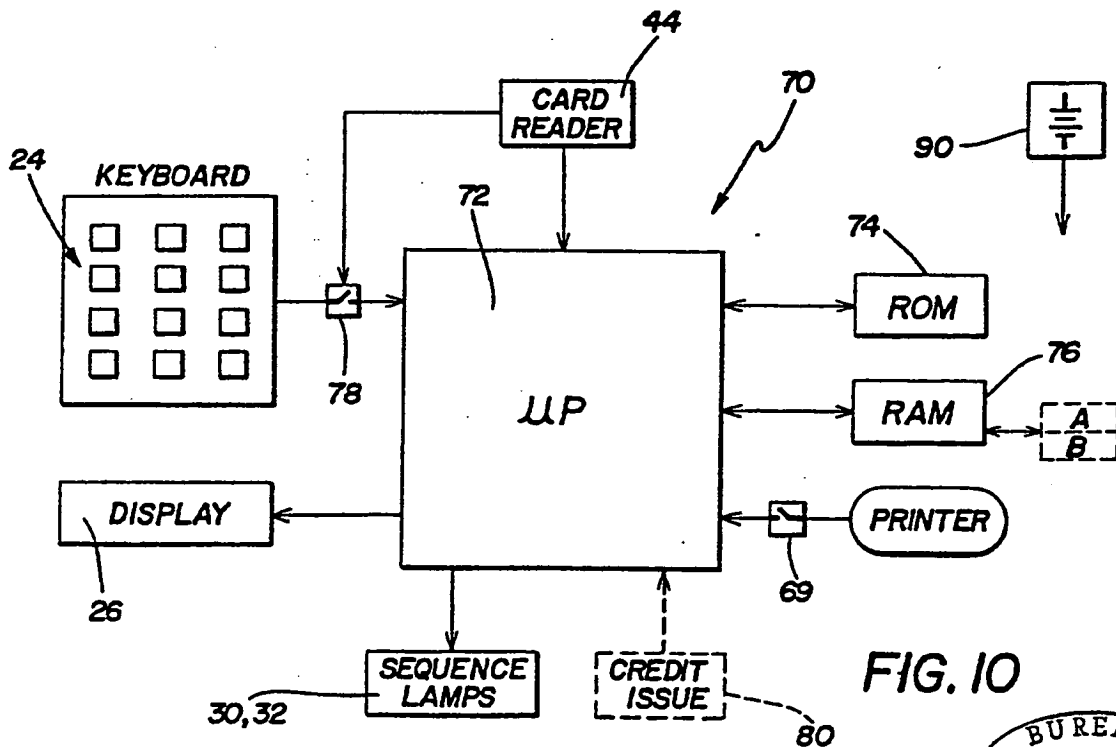
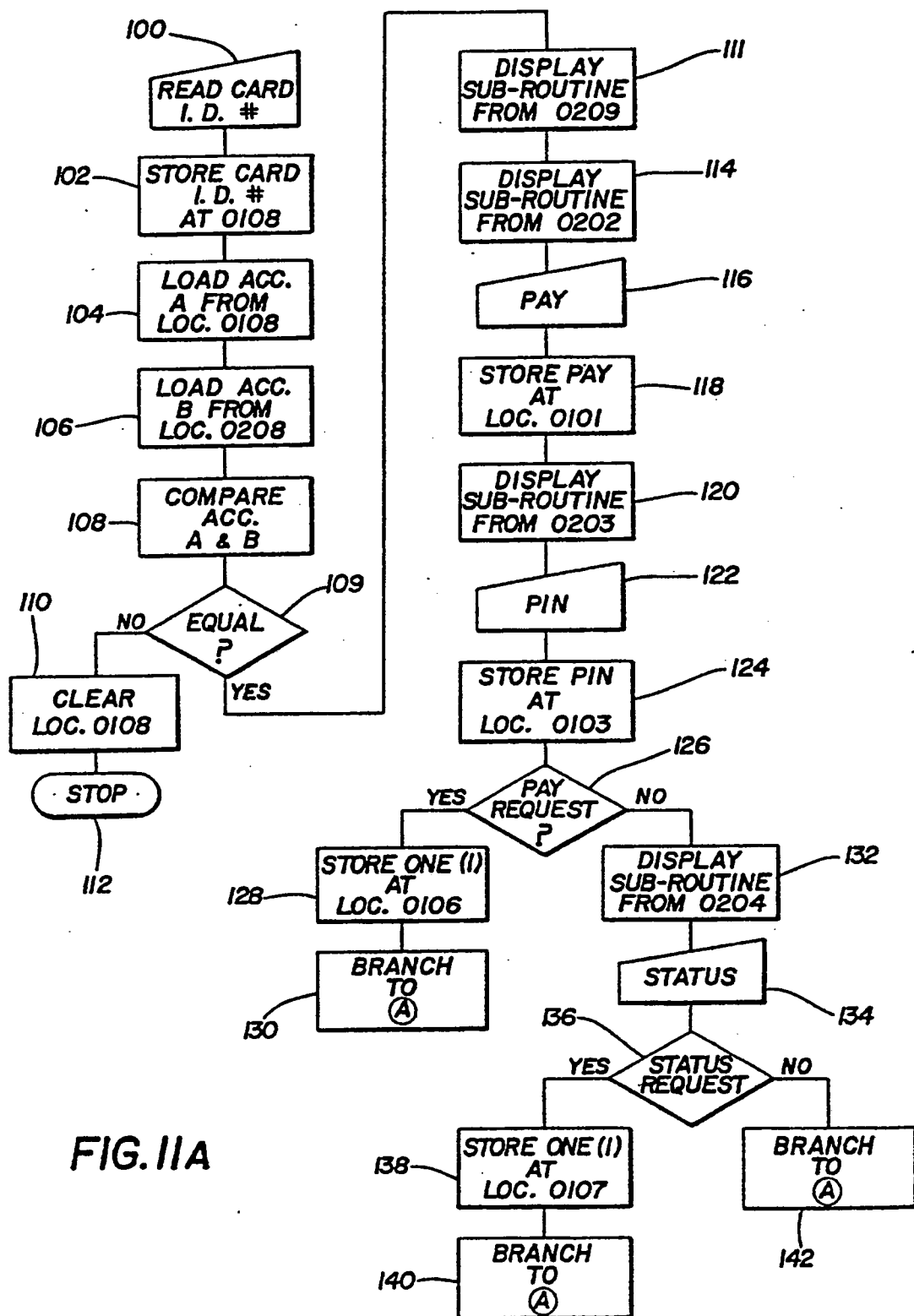


FIG. 10



4/7



5/7

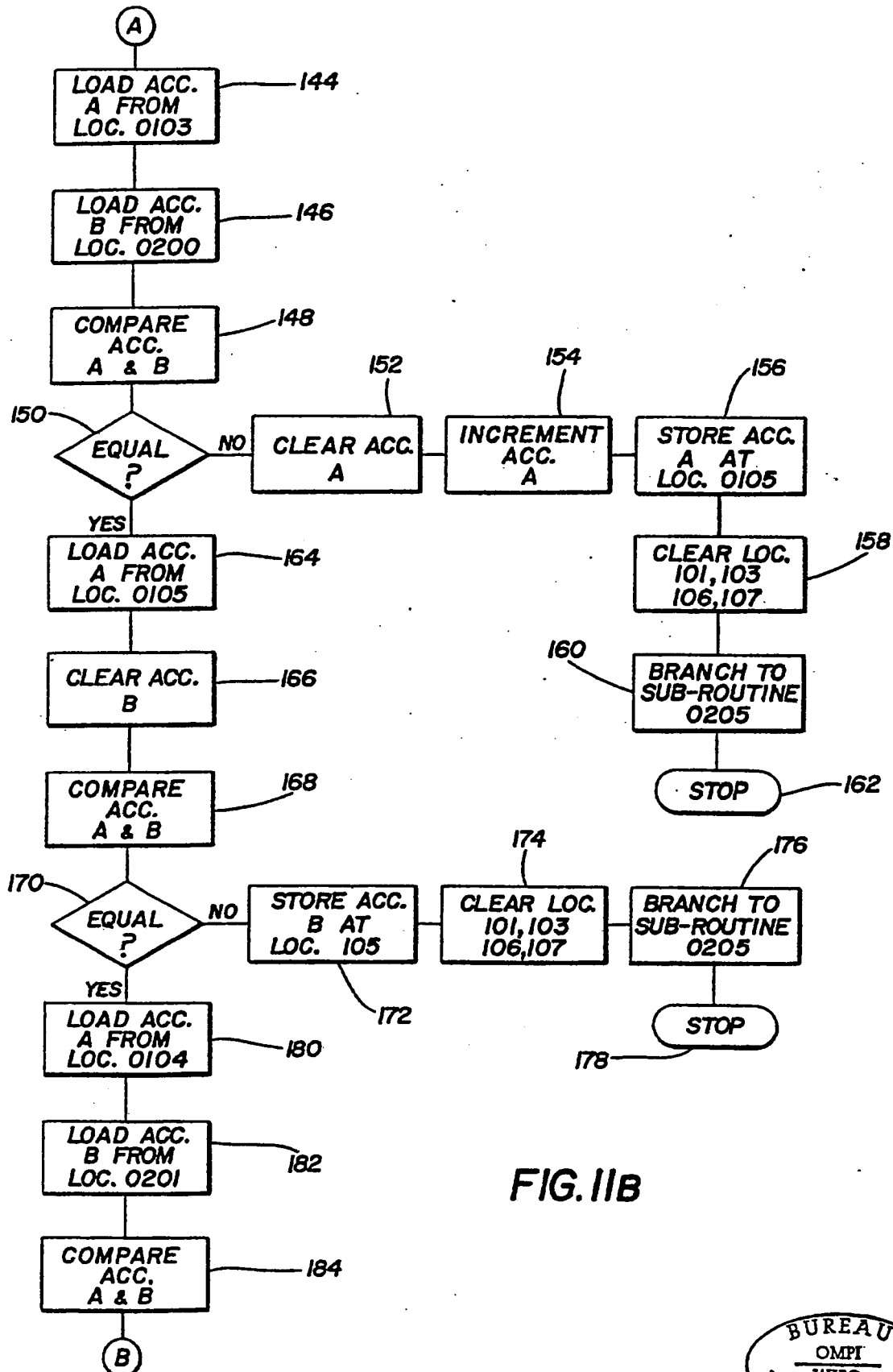


FIG. 11B



6/7

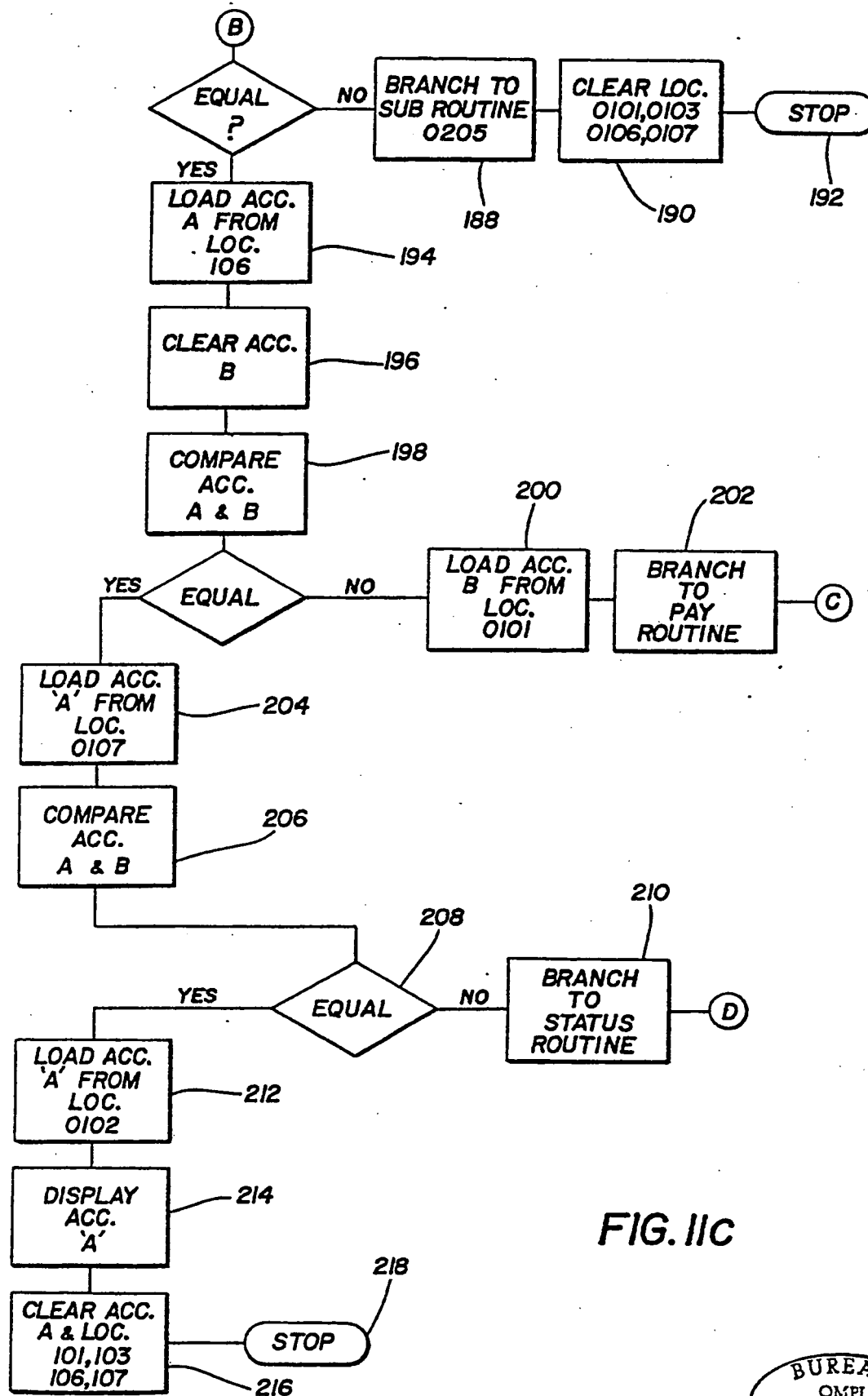


FIG. 11c

7/7

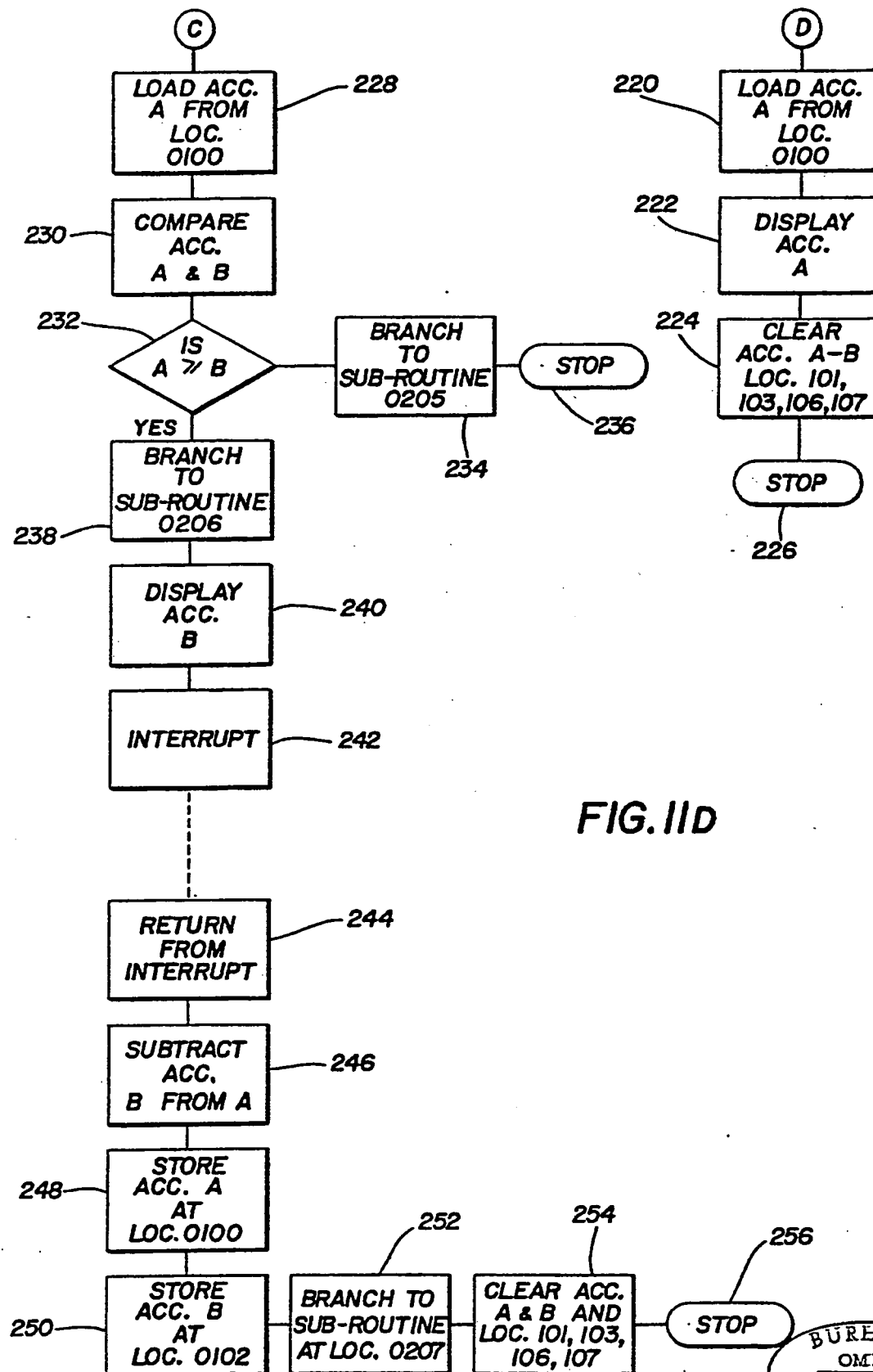


FIG. 11D

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US81/00431

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) *

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.³ G06 F 15/30; G06K 5/00

U.S. Cl. 235/379

II. FIELDS SEARCHED

Minimum Documentation Searched *

Classification System

Classification Symbols

U.S.

235/379, 380, 382, 432; 340/149R, 149 A, 318
152; 364/401, 406, 518, 708, 709, 710

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched *

III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴

Category *	Citation of Document, ¹⁵ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸
A	US, A, 3,651,310, Published 21 March 1972, Link.	
A	US, A, 3,934,122, Published 20 January 1976, Riccitelli	
A	US, A, 3,982,103, Published 21 September 1976, Goldman	
A	US, A, 4,001,550, Published 04 January 1977, Schatz	
A	US, A, 4,007,355, Published 08 February 1977, Moreno	
A	US, A, 4,032,931, Published 28 June 1977, Haker	
A	US, A, 4,053,735, Published 11 October 1977, Foudos	
A	US, A, 4,105,156, Published 08 August 1978, Dethloff	

* Special categories of cited documents: ¹⁵

"A" document defining the general state of the art

"E" earlier document but published on or after the international filing date

"L" document cited for special reason other than those referred to in the other categories

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but on or after the priority date claimed

"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention

"X" document of particular relevance

IV. CERTIFICATION

Date of the Actual Completion of the International Search *

13 July 1981

Date of Mailing of this International Search Report *

04 AUG 1981

International Searching Authority ¹

ISA/US

Signature of Authorized Officer ²⁰

Thomas A. Robinson

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

- | | |
|---|--|
| A | US, A, 4,115,870, Published 19 September 1978,
Lowell |
| A | US, A, 4,172,552, Published 30 October 1979,
Case et al |
| A | US, A, 4,197,986, Published 15 April 1980,
Nagata |

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE ¹⁰

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers _____, because they relate to subject matter ¹¹ not required to be searched by this Authority, namely:

2. ☐ Claim numbers _____, because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out ¹², specifically:

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING ¹³

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.